

## CLAIMS

1. A structured triglyceride comprising a glycerol backbone having three fatty acid residues esterified thereto, wherein at least one fatty acid residue is selected from the group consisting of C<sub>6</sub>-C<sub>12</sub> fatty acids and active derivatives thereof, and at least one fatty acid residue is selected from the group consisting of C<sub>14</sub>-C<sub>18</sub> fatty acids, C<sub>20</sub>-C<sub>22</sub> fatty acids, and active derivatives thereof, with the proviso that a C<sub>18</sub>-C<sub>22</sub> ω-3 fatty acid residue is not present on the same glycerol backbone together with gamma linolenic acid or dihomogamma linolenic acid.
2. The structured triglyceride according to claim 1, wherein the C<sub>14</sub>-C<sub>18</sub> fatty acids are selected from the group consisting of myristic acid, palmitic acid, palmitoleic acid, stearic acid, oleic acid, linoleic acid, alpha linolenic acid, and any combination thereof.
3. The structured triglyceride according to claim 1, wherein the C<sub>20</sub>-C<sub>22</sub> fatty acids are selected from the group consisting of arachidonic acid, eicosapentaenoic acid, docosahexaenoic acid, and any combination thereof.
4. The structured triglyceride according to claim 1, wherein the C<sub>14</sub>-C<sub>18</sub> fatty acids and the C<sub>20</sub>-C<sub>22</sub> fatty acids are selected from the group consisting of ω-3, ω-6, ω-9 fatty acids, and any combination thereof.
5. A structured triglyceride comprising a glycerol backbone having three fatty acid residues esterified thereto, wherein at least one fatty acid residue is selected from the group consisting of C<sub>6</sub>-C<sub>12</sub> fatty acids and active derivatives thereof in the internal position of the triglyceride backbone, and at least one fatty acid residue is selected from the group consisting of C<sub>14</sub>-C<sub>18</sub> fatty acids, C<sub>20</sub>-C<sub>22</sub> fatty acids, and active derivatives thereof in an external position of the triglyceride backbone.
6. The structured triglyceride according to claim 5, wherein the C<sub>14</sub>-C<sub>18</sub> fatty acids are selected from the group consisting of myristic acid, palmitic acid, palmitoleic acid, stearic acid, oleic acid, linoleic acid, alpha linolenic acid, and any combination thereof.

7. The structured triglyceride according to claim 5, wherein the C<sub>20</sub>-C<sub>22</sub> fatty acids are selected from the group consisting of arachidonic acid, eicosapentaenoic acid, docosahexaenoic acid, and any combination thereof.
8. The structured triglyceride according to claim 5, wherein the C<sub>14</sub>-C<sub>18</sub> fatty acids and the C<sub>20</sub>-C<sub>22</sub> fatty acids are selected from the group consisting of  $\omega$ -3,  $\omega$ -6,  $\omega$ -9 fatty acids, and any combination thereof.
9. A parenteral nutrition emulsion composition comprising a structured triglyceride, the structured triglyceride comprising a glycerol backbone having three fatty acid residues esterified thereto, wherein at least one fatty acid residue is selected from the group consisting of C<sub>6</sub>-C<sub>12</sub> fatty acids and active derivatives thereof, and at least one fatty acid residue is selected from the group consisting of C<sub>14</sub>-C<sub>18</sub> fatty acids, C<sub>20</sub>-C<sub>22</sub> fatty acids, and active derivatives thereof, with the proviso that a C<sub>18</sub>-C<sub>22</sub>  $\omega$ -3 fatty acid residue is not present on the same glycerol backbone together with gamma linolenic acid or dihomogamma linolenic acid.
10. The parenteral nutrition emulsion composition according to claim 9 comprising a majority of structured triglycerides having one fatty acid residue selected from the group consisting of C<sub>14</sub>-C<sub>18</sub> fatty acids, C<sub>20</sub>-C<sub>22</sub> fatty acids, and active derivatives thereof, and two fatty acid residues selected from the group consisting of C<sub>6</sub>-C<sub>12</sub> fatty acids and active derivatives thereof.
11. The parenteral nutrition emulsion composition according to claim 10, wherein the structured triglycerides having one fatty acid residue selected from the group consisting of C<sub>14</sub>-C<sub>18</sub> fatty acids, C<sub>20</sub>-C<sub>22</sub> fatty acids, and active derivatives thereof, and two fatty acid residues selected from the group consisting of C<sub>6</sub>-C<sub>12</sub> fatty acids and active derivatives thereof, said structured triglycerides comprise from about 80% to about 100% of total structured triglycerides of said emulsion.
12. The parenteral nutrition emulsion composition according to claim 9, wherein the C<sub>14</sub>-C<sub>18</sub> fatty acids and the C<sub>20</sub>-C<sub>22</sub> fatty acids are selected from the group consisting of  $\omega$ -3,  $\omega$ -6,  $\omega$ -9 fatty acids, and any combination thereof.
13. The parenteral nutrition emulsion composition according to claim 9, comprising from about 9 to about 90% by weight C<sub>6</sub>-C<sub>12</sub> fatty acids based on the weight of total fatty acids.

14. The parenteral nutrition emulsion composition according to claim 9, comprising from about 40 to about 50% by weight C<sub>6</sub>-C<sub>12</sub> fatty acids based on the weight of total fatty acids.
- 5 15. The parenteral nutrition emulsion composition according to claim 9, comprising from about 9 to about 90% by weight C<sub>14</sub>-C<sub>18</sub> fatty acids based on the weight of total fatty acids.
16. The parenteral nutrition emulsion composition according to claim 9, comprising from about 35 to about 55% by weight C<sub>14</sub>-C<sub>18</sub> fatty acids based on the weight of total fatty acids.
- 10 17. The parenteral nutrition emulsion composition according to claim 9, comprising from about 1 to about 10% by weight C<sub>20</sub>-C<sub>22</sub> fatty acids based on the weight of total fatty acids.
18. The parenteral nutrition emulsion composition according to claim 9, comprising from about 4.5 to about 5.5% by weight C<sub>20</sub>-C<sub>22</sub> fatty acids based on the weight of total fatty acids.
- 15 19. The parenteral nutrition emulsion composition according to claim 9, wherein the  $\omega$ -6 fatty acids and the  $\omega$ -3 fatty acids are in a ratio of about 7:1 to about 1:1.
20. The parenteral nutrition emulsion composition according to claim 19, wherein the  $\omega$ -6 fatty acids and the  $\omega$ -3 fatty acids are in a ratio of about 2:1 to about 1.5:1.
- 20 21. The parenteral nutrition emulsion composition according to claim 9, wherein the structured triglyceride constitutes from about 10 to about 40% (w/v) of the composition.
22. The parenteral nutrition emulsion composition according to claim 9, wherein the structured triglyceride constitutes from about 20 to about 25% (w/v) of the composition.
- 25 23. The parenteral nutrition emulsion composition according to claim 9, wherein a droplet size of said emulsion is lower than about 1  $\mu$ m.
24. The parenteral nutrition emulsion composition according to claim 9, wherein a droplet size of said emulsion is lower than about 0.22  $\mu$ m.
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25. The parenteral nutrition emulsion composition according to claim 9, further comprising tocopherol.

26. The parenteral nutrition emulsion according to claim 25, wherein the tocopherol is alpha tocopherol.

27. The parenteral nutrition emulsion according to claim 9, further comprising an emulsifier.

28. The parenteral nutrition emulsion according to claim 9, further comprising at least one component selected from the group consisting of surfactants, carbohydrates, vitamins, amino acids, trace minerals, osmolality modifiers and water.

29. The parenteral nutrition composition according to any one of claims 9 to 28 comprising:

(a) 20% (w/v) structured triglycerides comprising:

about 40-50% by weight C<sub>6</sub>-C<sub>12</sub> fatty acids based on the weight of total fatty acids, wherein the C<sub>6</sub>-C<sub>12</sub> fatty acids comprise 0-5% caproic acid, 20-30% caprylic acid, 10-30% capric acid, and 0-5% lauric acid by weight based on the weight of total fatty acids;

about 35-55% by weight C<sub>14</sub>-C<sub>18</sub> fatty acids based on the weight of total fatty acids, wherein the C<sub>14</sub>-C<sub>18</sub> fatty acids comprise 0-5% myristic acid, 5-30% palmitic acid, 0-5% palmitoleic acid, 0-5% stearic acid, 10-30% oleic acid, 10-30% linoleic acid, and 5-15% alpha linolenic acid by weight based on the weight of total fatty acids; and

about 1-10% C<sub>20</sub>-C<sub>22</sub> by weight fatty acids based on the weight of total fatty acids, wherein the C<sub>20</sub>-C<sub>22</sub> fatty acids comprise 1-5% AA, 0-5% EPA, and 1-5% DHA by weight based on the weight of total fatty acids, wherein the ratio of  $\omega$ -6 to  $\omega$ -3 fatty acids is about 1:1 to about 2:1;

(b) 1.2% (w/v) phospholipids;

(c) 1.8-2.0 mg/1 g of fatty acids alpha tocopherol;

(d) 0-25 g/L glycerin; and

(e) water.

30. The parenteral nutrition emulsion composition according to claim 29 comprising:

(a) about 20% (w/v) structured triglycerides comprising:

about 45% by weight C<sub>6</sub>-C<sub>12</sub> fatty acids based on the weight of total fatty acids, wherein the C<sub>6</sub>-C<sub>12</sub> fatty acids comprise 2.5% caproic acid, 30% caprylic acid, 10% capric acid, and 2.5% lauric acid by weight based on the weight of total fatty acids;

about 50% by weight C<sub>14</sub>-C<sub>18</sub> fatty acids based on the weight of total fatty acids, wherein the C<sub>14</sub>-C<sub>18</sub> fatty acids comprise 10% palmitic acid, 2.5% stearic acid, 15% oleic acid, 16% linoleic acid, and 7% alpha linolenic acid by weight based on the weight of total fatty acids; and

about 5% by weight C<sub>20</sub>-C<sub>22</sub> fatty acids based on the weight of total fatty acids, wherein the C<sub>20</sub>-C<sub>22</sub> fatty acids comprise 1.5% AA, 1.5% EPA, and 1.5% DHA by weight based on the weight of total fatty acids, wherein the ratio of  $\omega$ -6 to  $\omega$ -3 fatty acids is 1.75;

(b) about 1.2% (w/v) phospholipids;

(c) about 1.8 mg/1 g of fatty acids alpha tocopherol;

(d) about 10-25 g/L glycerin; and

(e) water.

31. A parenteral nutrition emulsion composition comprising a structured triglyceride, the structured triglyceride comprising a glycerol backbone having three fatty acid residues esterified thereto, wherein at least one fatty acid residue is selected from the group consisting of C<sub>6</sub>-C<sub>12</sub> fatty acids and active derivatives thereof in the internal position of the triglyceride backbone, and at least one fatty acid residue is selected from the group consisting of C<sub>14</sub>-C<sub>18</sub> fatty acids, C<sub>20</sub>-C<sub>22</sub> fatty acids, and active derivatives thereof in an external position of the triglyceride backbone.

32. The parenteral nutrition emulsion composition according to claim 31 comprising a majority of structured triglycerides having one fatty acid residue selected from the group consisting of C<sub>14</sub>-C<sub>18</sub> fatty acids, C<sub>20</sub>-C<sub>22</sub> fatty acids, and active derivatives thereof in an external position, and two fatty acid residues selected from the group consisting of C<sub>6</sub>-C<sub>12</sub> fatty acids and active derivatives thereof.

33. The parenteral nutrition emulsion composition according to claim 32, wherein the structured triglycerides having one fatty acid residue selected from the group

consisting of C<sub>14</sub>-C<sub>18</sub> fatty acids, C<sub>20</sub>-C<sub>22</sub> fatty acids, and active derivatives thereof in an external position, and two fatty acid residues selected from the group consisting of C<sub>6</sub>-C<sub>12</sub> fatty acids and active derivatives thereof, said structured triglycerides comprise of about 80% to about 100% of total triglycerides of said emulsion.

34. The parenteral nutrition emulsion composition according to claim 31, wherein the C<sub>14</sub>-C<sub>18</sub> fatty acids and the C<sub>20</sub>-C<sub>22</sub> fatty acids are selected from the group consisting of  $\omega$ -3,  $\omega$ -6,  $\omega$ -9 fatty acids, and any combination thereof.

35. The parenteral nutrition emulsion composition according to claim 31, comprising from about 9 to about 90% by weight C<sub>6</sub>-C<sub>12</sub> fatty acids based on the weight of total fatty acids.

36. The parenteral nutrition emulsion composition according to claim 31, comprising from about 40 to about 50% by weight C<sub>6</sub>-C<sub>12</sub> fatty acids based on the weight of total fatty acids.

37. The parenteral nutrition emulsion composition according to claim 31, comprising from about 9% to about 90% by weight C<sub>14</sub>-C<sub>18</sub> fatty acids based on the weight of total fatty acids.

38. The parenteral nutrition emulsion composition according to claim 31, comprising from about 35% to about 55% by weight C<sub>14</sub>-C<sub>18</sub> fatty acids based on the weight total fatty acids.

39. The parenteral nutrition emulsion composition according to claim 31, comprising from about 1% to about 10% by weight C<sub>20</sub>-C<sub>22</sub> fatty acids based on the weight of total fatty acids.

40. The parenteral nutrition emulsion composition according to claim 31, comprising from about 4.5% to about 5.5% by weight C<sub>20</sub>-C<sub>22</sub> fatty acids based on the weight of total fatty acids.

41. The parenteral nutrition emulsion composition according to claim 31, wherein the  $\omega$ -6 fatty acids and the  $\omega$ -3 fatty acids are in a ratio of about 7:1 to about 1:1.

42. The parenteral nutrition emulsion composition according to claim 41, wherein the  $\omega$ -6 fatty acids and the  $\omega$ -3 fatty acids are in a ratio of about 2:1 to about 1.5:1.

43. The parenteral nutrition emulsion composition according to claim 31, wherein the structured triglyceride constitutes from about 10 to about 40% (w/v) of the composition.
- 5 44. The parenteral nutrition emulsion composition according to claim 31, wherein the structured triglyceride constitutes from about 20 to about 25% (w/v) of the composition.
45. The parenteral nutrition emulsion composition according to claim 31, wherein a droplet size of said emulsion is lower than about 1  $\mu\text{m}$ .
- 10 46. The parenteral nutrition emulsion composition according to claim 31, wherein a droplet size of said emulsion is lower than about 0.22  $\mu\text{m}$ .
47. The parenteral nutrition emulsion composition according to claim 31, further comprising tocopherol.
48. The parenteral nutrition emulsion according to claim 47, wherein the tocopherol is alpha tocopherol.
- 15 49. The parenteral nutrition emulsion according to claim 31, further comprising an emulsifier.
50. The parenteral nutrition emulsion according to claim 31, further comprising at least one component selected from the group consisting of surfactants, carbohydrates, vitamins, amino acids, trace minerals, osmolality modifiers and water.
- 20 51. The parenteral nutrition emulsion according to any one of claim 31 to 50 comprising:
- (a) 20% (w/v) structured triglycerides comprising:
- 25 about 40-50% by weight  $\text{C}_6\text{-C}_{12}$  fatty acids based on the weight of total fatty acids, wherein the  $\text{C}_6\text{-C}_{12}$  fatty acids comprise 0-5% caproic acid, 20-30% caprylic acid, 10-30% capric acid, and 0-5% lauric acid by weight based on the weight of total fatty acids;
- 30 about 35-55% by weight  $\text{C}_{14}\text{-C}_{18}$  fatty acids based on the weight of total fatty acids, wherein the  $\text{C}_{14}\text{-C}_{18}$  fatty acids comprise 0-5% myristic acid, 5-30% palmitic acid, 0-5% palmitoleic acid, 0-5% stearic acid, 10-

30% oleic acid, 10-30% linoleic acid, and 5-15% alpha linolenic acid by weight based on the weight of total fatty acids; and

about 1-10% C<sub>20</sub>-C<sub>22</sub> by weight fatty acids based on the weight of total fatty acids, wherein the C<sub>20</sub>-C<sub>22</sub> fatty acids comprise 1-5% AA, 0-5% EPA, and 1-5% DHA by weight based on the weight of total fatty acids, wherein the ratio of  $\omega$ -6 to  $\omega$ -3 fatty acids is 1:1-2:1;

(b) 1.2% (w/v) phospholipids;

(c) 1.8-2.0 mg/1 g of fatty acids alpha tocopherol;

(d) 0-25 g/L glycerin; and

(e) water.

52. The parenteral nutrition emulsion composition according to claim 51 comprising:

(a) about 20% (w/v) structured triglycerides comprising:

about 45% by weight C<sub>6</sub>-C<sub>12</sub> fatty acids based on the weight of total fatty acids, wherein the C<sub>6</sub>-C<sub>12</sub> fatty acids comprise 2.5% caproic acid, 30% caprylic acid, 10% capric acid, and 2.5% lauric acid by weight based on the weight of total fatty acids;

about 50% by weight C<sub>14</sub>-C<sub>18</sub> fatty acids based on the weight of total fatty acids, wherein the C<sub>14</sub>-C<sub>18</sub> fatty acids comprise 10% palmitic acid, 2.5% stearic acid, 15% oleic acid, 16% linoleic acid, and 7% alpha linolenic acid by weight based on the weight of total fatty acids; and

about 5% by weight C<sub>20</sub>-C<sub>22</sub> fatty acids based on the weight of total fatty acids, wherein the C<sub>20</sub>-C<sub>22</sub> fatty acids comprise 1.5% AA, 1.5% EPA, and 1.5% DHA by weight based on the weight of total fatty acids, wherein the ratio of  $\omega$ -6 to  $\omega$ -3 fatty acids is 1.75;

(b) about 1.2% (w/v) phospholipids;

(c) about 1.8 mg/1 g of fatty acids alpha tocopherol;

(d) about 10-25 g/L glycerin; and

(e) water.

53. A process of synthesizing a structured triglyceride according to any one of claims 1 to 8 comprising the step of performing an acidolysis reaction..

54. The process according to claim 53, wherein the acidolysis reaction is catalyzed by a lipase.



55. The process according to claim 53, wherein the triglyceride is a medium chain triglyceride.
56. The process according to claim 53, wherein the fatty acid is selected from the group consisting of C<sub>14</sub>-C<sub>18</sub> fatty acids, C<sub>20</sub>-C<sub>22</sub> fatty acids, and active derivatives thereof.
57. The process according to claim 53 further comprising a step of distilling the reaction mixture to remove non-reacted MCT and fatty acid.
58. A process of preparing a parenteral nutrition emulsion composition according to any one of claims 9 to 52 comprising the step of reducing the droplet size of the emulsion below of about 1  $\mu$ m.
59. The process according to claim 58 comprising the step of reducing the droplet size below of about 0.45  $\mu$ m.
60. The process according to claim 58 comprising the step of reducing the droplet size below of about 0.22  $\mu$ m.
61. A method of providing nutrition to a subject in need thereof comprising parenterally administering to the subject a parenteral nutrition emulsion composition according to any one of claims 9 to 52.
62. The method according to claim 61, wherein the subject is a preterm infant, a term infant, a child, an adult, a critically ill patient, a cancer patient, or a patient suffering from one of the conditions selected from trauma, burns, malnutrition, starvation, aging, and immunosuppression.
63. The method according to claim 61, wherein the subject is an AIDS patient.